Undergraduate Research Experience in Ocean/Marine Science at ECSU

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LONG-TERM GOALS

The URE-Ocean/Marine Science program supports active research participation by undergraduate students in an area of interest to the Office of Naval Research. The program is based on a model for undergraduate research programs supported by the National Science Foundation. The URE project features high quality interactions with faculty and/or other research mentors and access to appropriate facilities and professional development opportunities. It is the long term goal of the URE in Ocean/Marine Science to provide an active research experience as an effective way to attract talented undergraduates and retain them in careers in ocean and marine science.

OBJECTIVES

The program objective is to promote the professional development of under-represented undergraduate students through their participation in ongoing ocean and marine science research. During the summer 2001 program, research team investigations focused on:

- Coast Watch Remote Sensing Data Validation Study
- ARCVIEW/GIS Software as a Tool for Evaluating Coastal Populations
- Validation of LITE Tropospheric and Stratospheric Measurements

APPROACH

Applications were accepted from throughout the country. Undergraduate students selected were citizens or permanent residents of the United States. Each student was assigned to a specific research team, where he/she worked closely with the faculty. In addition, seminars, lunch meetings, and social functions were organized to facilitate interaction. The project was conducted for six weeks during summer 2001, with on-line mentoring and follow-up during academic year 2001-02. Each student was granted a stipend of $300 per week, housing, and in some cases assistance with travel. Students who are in those groups traditionally under-represented in science (women and members of under-represented minorities) were particularly urged to apply. The program comprises a group of twelve undergraduates.

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14. ABSTRACT

The URE-Ocean/Marine Science program supports active research participation by undergraduate students in an area of interest to the Office of Naval Research. The program is based on a model for undergraduate research programs supported by the National Science Foundation. The URE project features high quality interactions with faculty and/or other research mentors and access to appropriate facilities and professional development opportunities. It is the long term goal of the URE in Ocean/Marine Science to provide an active research experience as an effective way to attract talented undergraduates and retain them in careers in ocean and marine science.

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The program timeline was as follows:

- Spring 2001: Develop website and fliers to advertise the program; select 12 participants.

- Summer 2001: Six weeks of training in Ocean and Marine Science, four visiting lectures, opening and closing programs, student projects published on the web and in print form.

- Academic Year 2001-2002: On-line mentoring of students by faculty and advising students on applying for summer 2002 Ocean and Marine Science internships.

WORK COMPLETED

Three research teams were formed. Each team's abstract is given below.

Team #1: Coast Watch Remote Sensing Validation Study. Coast Watch is a National Oceanic and Atmospheric Administration (NOAA) program that provides remotely sensed satellite data to government decision-makers and academic researchers. Coast Watch data are used in a variety of ways including: monitoring sea surface temperatures, studying fish and marine mammal distribution, and aiding in atmospheric forecasting. Studying and monitoring sea surface temperature is very important. Sea surface temperature aids in monitoring coral reefs, fisherman decision making, and studying other earth system science phenomena.

The Coast Watch Validation Study team conducted research to determine the reliability and accuracy of Coast Watch. To conduct this study Coast Watch software, AVHRR datasets, and ground truthing were used. AVHRR composites were also created and analyzed. Those composites were then compared to data collected from various sources including buoys and the Field Research Facility (FRF is a coastal and hydraulic facility located in Duck, North Carolina).

Team #2: ARCVIEW/GIS Software as a Tool for Evaluating Coastal Populations. A population map of the United States reveals a certainty: nearly everybody likes to live near the water. More than half the population lives on or near coasts, which are less than one-fifth of the land in the contiguous United States. From 1960 to 1990 the population of coastal areas increased from 80 to 110 million and is projected to reach 127 million by the year 2010. Because of this large number, coastal area planners have to devise methods for gathering and analyzing information regarding populated areas. Issues such as comprehensive land-use, farmland preservation, zoning, traffic signalization, roadway structuring, and bridge sufficiency ratings have to be put into numbers and studied because they are of geographic importance and relate to population.

The most effective tool for handling such a task is the ARCVIEW/GIS. The spatial capabilities of ARCVIEW/GIS allow for consistent quality in its modeling features by producing digital maps with vector features produced using arcs, nodes, polygons, and label points. This in turn allowed us to interpret and understand the information that has been gathered by the area planners and processed by the GIS. It also allowed for estimations and predictions of population. These benefits are difficult to obtain using spreadsheet or other non-graphic methods of data organization. Once the data were interpreted through ARCVIEW/GIS, they were combined with other data to form correlations. This project investigated ARC/INFO techniques and tools that can be used to evaluate population number

and growth in coastal areas. Correlations and patterns were also investigated in regards to how the number of roads affect population in coastal areas.

Team #3: Validation of LITE Tropospheric and Stratospheric Measurements. The Lidar-In-Space-Technology-Experiment (LITE) was flown on the STS-64 in September of 1994. LITE was the first lidar developed to fly in Earth's orbit and perform atmospheric studies. The LITE mission had three major objectives: validate instruments for operational spaceborne lidars; explore as many applications of spaceborne lidars as possible; and gather information on the range and variability of cloud, aerosol, and surface return signals for use in designing future systems. LITE used a Nd:YAG laser operating at three channels (1064 nm, 532 nm, and 355 nm) to study Earth's lower atmosphere.

This project used a single scatter lidar equation to investigate tropospheric and stratospheric aerosol and temperature measurements derived from the 355 and 532 nm channels. Temperature profiles of 355 nm channel were compared to coincident balloonsonde measurements between 5 and 40 km. The results were discussed. The 355 nm channel temperature profiles were corrected for aerosol scattering using the 532 nm channel and an assumed Angstrom coefficient. The RMS between the corrected profiles and the balloonsonde data were computed.

RESULTS

The URE project features high quality interactions with faculty and/or other research mentors, structured research projects, and professional development opportunities.

Faculty and/or other research mentors included:

- Dr. Raj Chaudhury, Norfolk State University
- Dr. Timothy Olsen, Univ. of Wisconsin-Madison
- Dr. Ali Omar, Hampton Univ.
- Dr. William Porter, ECSU
- Dr. Linda Hayden, ECSU
- Dr. Charles Sun, NOAA Coastal Oceans Laboratory

Professional development opportunities included:

- Naval Air Station - Oceania Tour
- Norfolk Naval Base Tour
- National Marine Fisheries Service - Woods Hole Meeting
- Cape Hatteras Light House and Sand Dunes Tour
- Earth System Science Academy
- Field Research Facility at Duck, NC

Structured research projects included:

- Coast Watch Remote Sensing Data Validation Study
- ARCVIEW/GIS Software as a Tool for Evaluating Coastal Populations
- Validation of LITE Tropospheric and Stratospheric Measurements

IMPACT/APPLICATIONS

In addition to increasing the participation of under-represented groups in ocean/marine science, another impact of the program was involving students in research who might not otherwise have the opportunity. Therefore, the URE in Ocean/Marine Science Program had an impact on students from institutions where research programs and opportunities are limited. Note that during the 2001 program, a significant number of student participants came from outside Elizabeth City State University.

Both a flier announcing the program and a webpage were developed to recruit students. Particular attention was paid to recruiting students via the MU-SPIN NRTS consortium of NASA's Goddard Space Flight Center. This structure of recruitment will be continued to ensure that the program will reach a large number of under-represented students. The structure of the MU-SPIN Office of Goddard Space Flight Center includes 54 HBCU/MIs.

TRANSITIONS

The project is just beginning. No transitions are available for this reporting period.

RELATED PROJECTS

While the URE in Ocean/Marine Science program provides an intensive summer experience, the program, entitled "ONR Nurturing ECSU Research Talent (NERT)," focuses on undergraduate education and undergraduate research experiences during the academic year. Nurturing these young researchers is a primary concern. Highest priority is given to providing them with the guidance and skills to ensure their entrance and success in graduate school. Further, each student learns the fundamentals of scientific research, in a team setting, under the guidance of a faculty mentor. ONR has funded the NERT program for the past 8 years. Highlights from the ONR-NERT program can be found at http://nia.ecsu.edu/onr/onr.html. NERT program activities include both student development activities and department infrastructure activities.

The 2000-2001 Office of Naval Research Nurturing ECSU Research Talent program involved 28 undergraduates majoring in mathematics, computer science, physics, and technology. Research training meetings began September 7, 2000 and were held every Tuesday and Thursday through April 17, 2001. Meetings were conducted from 5-8 pm. Research training meetings started with a 20-30 minute announcement period during which time students learned about internship opportunities, heard program announcements, gave team reports, and discussed travel logistics and program goals. Following the announcement period, students met with faculty mentors or attended training on the tools used for research. The closing program was held on two nights in April. During the closing program, students made oral presentations of their research training activities. All research teams were

also required to complete written reports. In addition, students spent 20 hours/week in the undergraduate research laboratory completing task sheet requirements and research assignments.

The program this year resulted in each of the graduating seniors being admitted to graduate school with fellowships. One student is scheduled to complete the Bachelor of Science degree in December 2001. With respect to the Graduate Success Program, two students completed a Master of Science degree in computer science from North Carolina A&T University. One student completed the Master of Science degree in Mathematics at Hampton University and two completed the Master of Science in Physics at Hampton University. Thirty-seven NERT program alumni have completed or are working on the graduate degree.

Summer internship placement was also impressive including: The Naval Research Virtual Reality Laboratory, Fermi National Accelerator Laboratory, Federal Aviation Association, ONR Ocean/Marine Science Undergraduate Research Experience, University of Wisconsin Visualization Program, Institute in Computational Science-Scientific Visualization, and SCSU Research Institute in Astrophysics.

Students presented their research activities at several undergraduate research conferences including the Seizing Opportunities to Advance Research (SOAR) on the campus of North Carolina A&T University and the NAFEO High Tech Expo in Washington, DC. In addition, juniors attended the Graduate School Focus Program on the campus of Georgia Tech, while seniors attended the Graduate Record Examination Forum in New York. All juniors and seniors registered for and took the Graduate Record Examination (GRE).

A total of $108,000.00 in scholarships was awarded during academic year 00-01. An additional $11,000.00 was awarded through the Graduate Success Program to support program alumni who are pursuing graduate degrees.

REFERENCES

Conway, Eric and The Maryland Space Grant Consortium, “An Introduction to Satellite Image Interpretation,” John Hopkins University Press, 1997.

Turner and Barksdale, “HTML and JavaScript Programming Concepts,” Southwestern Publishing, 2000.

“Getting to Know Arcview GIS Version 3.1,” ESRI Press, 1998 ISBN 1-879102-46-3.

Hayden, L., Published Interview, “A Winning Formula”, *American Magazine*, Winter 1994, p.15-20.

Hayden, L., Published Interview, “Success is in the Numbers”, *Black Issues in Higher Education*, May 19, 1994, p. 40-43.

Hayden, L., “Mentoring Minority Students Majoring in Mathematics and Science”, 9th International Conference on Technology and Education, Paris, France, 1992.

PUBLICATIONS

Hayden, L. and Sun, C., “Undergraduate Research Experience in Ocean/Marine Science,” 29th International Symposium on Remote Sensing of Environment, Buenos Aires, Argentina, April 8-12, 2002 (pending).

Jennings, T., Vinson, A., and Hayden, L., “Coast Watch Remote Sensing Data Validation Study,” National Technical Association 73rd Annual National Conference, Atlanta, GA , Sept. 26-29, 2001.

Walker, E. and Hayden, L., “Validation of LITE Tropospheric and Stratospheric Measurements,” National Technical Association 73rd Annual National Conference, Atlanta, GA, Sept. 26-29, 2001.

PATENTS

There were no patent applications/awards for the URE in Ocean/Marine Science Program.